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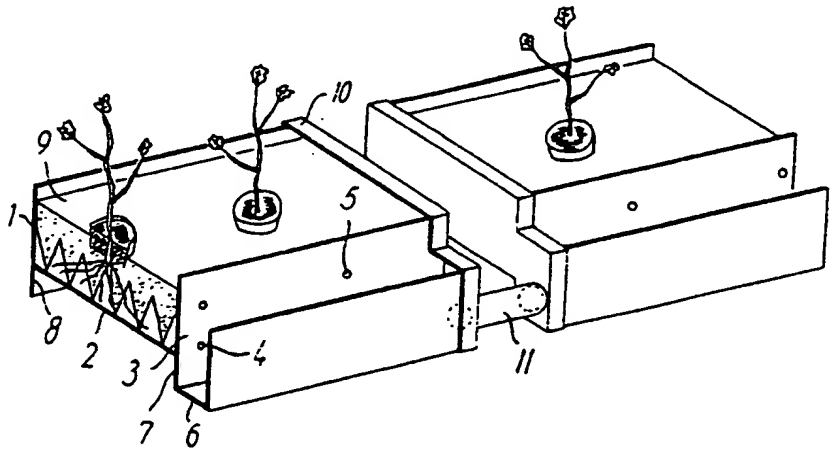

(57) Abstract

A plant-growth trough (1, 2, 3) for earthless growing of plants in planting sacks or growth plates (9) in which the trough (1, 2, 3) consists of sections restricted by walls (10) perpendicular to the longitudinal direction of the trough, each individual section having at least one drainage (4, 5) determining the liquid level in the section and communicating with a discharge channel separated from the trough. The discharge channel is constituted by a trough extending longitudinally of the growth trough, the bottom (6) of which is positioned at a lower level relative to the bottom (2) of the growth trough, the growth trough and the discharge channel having a common wall (3) through which the drainage openings of the growth trough are bored. The growth trough and the discharge channel may be provided integrally as an extruded profile sealed at its ends by walls (10) having nipples opposite the discharge channel for connection (11) with a discharge channel of a similar trough or for drainage of liquid. When mounted on a plane surface the growth trough (1, 2, 3) is supported at its end side by the discharge channel and at its other side by a supporting frame (8).

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Plant-Growth Trough for Earthless Growing of Plants.

The invention relates to a plant-growth trough for earthless growing of drip watered plants in planting sacks or growth plates of porous material in which the irrigation is supplied as dripping water close to the stem of the plant, said trough being divided into sections.

In modern glasshouse horticulture plants are to a large extent nurtured in earthless culture, in that the roots of the plants are growing into a porous, chemically inactive material in which water and the nutritious substances necessary for the growth of the plant are supplied by means of an irrigation system.

The porous material is frequently surrounded by a plastic encapsulation to form a planting sack from which the stem of the plant comes up through an opening at the upper side of the planting sack and through which the irrigation is likewise effected while excess water is drained away through one or more perforations at the bottom of the planting sack or in the sides thereof if it is desired to maintain a certain liquid level at the bottom of the planting sack.

The excess water either runs out on the earth in the glasshouse or discharges via gutters to a gully. This is disadvantageous as it entails, on one hand, an undesired wet climate within the glasshouse and, on the other hand, an environmental pollution due to percolation and discharge of fertilizer containing water.

Attempts have been made to remedy said disadvantage by arranging a series of said planting sacks with plants in a trough with plastic lining so that excess water may be collected at the end of the trough. This arrangement, however, has not prevented puddles from ccurring between the planting sacks from which evaporation contributes to humid glasshouse environments

and fungus diseases may as well spread with the drainage water from one planting sack to an ther.

It is also possible to grow plants in a plate-formed, chemically inactive, porous material disposed in a trough-shaped container, in which a constant water level is maintained, the supply of water being turned on when the water level falls below a desired level and turned off when the desired level has been attained. This method of irrigation is, however, complicated in comparison with the above mentioned one, according to which water is continuously supplied in an excess amount and the excess amount of water is drained away.

US patent 3 603 034 discloses a plant-growth trough in which plants are nurtured in a porous material filling the trough. The irrigation of the cultures is effected from a conduit centrally diposed at the bottom of the trough while excess water is discharged through channels extending within the trough throughout its length at the side walls of its bottom. Said structure does not make it possible to nurture cultures necessitating a constant level of water and the location of the discharge channels within the trough allows pathogenic germs to spread along the discharge channels throughout the length of the trough, irrespective of the fact that the trough by means of partition walls perpendicular to the longitudinal direction is divided into smaller sections, drainage water from one section getting access to the neighbouring section through the discharge channels.

In a plant-growth trough according to GB patent 1 162 188 it has been made possible to grow a culture requiring a certain level of water, the irrigation being effected from a system of ribs with perforations at the base, while excess water is drained away through a second system of ribs with perforations at a pr determined height above the base of the trough. The

drainage of the trough may be effected in that the system of ribs with perforations at the base of the trough is disconnected the water supply and used as discharge. Such an alternate use for irrigation and drainage purposes involves, however, the risk of transmitting infections.

As a consequence, it is the object of the invention to provide a plant-growth trough for earthless growing of plants in planting sacks or growth plates, said trough being applicable for the growing of drained cultures as well as for cultures requiring a certain level of water and making it possible to collect excess water from the individual cultures in such a manner that the discharge water is kept completely separated from the irrigation water so that spreading of diseases by water is prevented.

This is obtained by a plant-growth trough of the above mentioned type which according to the invention is characterized in that each section beyond at least one bottom discharge of the plant-growth trough includes at least one drainage in a more elevated position determining the liquid level in the section when the bottom discharge is plugged, and that the bottom discharge as well as the more elevated drainage are in communication with a discharge channel separated from the trough.

In a trough divided into sections outbreaking diseases are restricted to a single section, in that excess liquid from the section is drained away to the discharge channel separated from the trough and thus does not come into contact with the root structure of plants outside the section concerned. The drained-off liquid still containing nutritious substances may be collected at the end of the drainage channel and either be disinfected and reused or drained away after cleaning in so far it is necessary.

Due to the fact that each section according to the invention has at least one drainage at the bottom of the plant-growth trough it is possible to empty the plant-growth trough of liquid in excess of the liquid absorbed by the applied growth media, planting sack or plate, while the provision of additional drainages at different heights above the bottom of the growth trough makes it possible by plugging lower drainages to obtain an arbitrarily desired liquid level in the growth trough.

The discharge channel may according to the invention be formed by a trough extending longitudinally of the plant-growth trough the bottom of which is positioned at a lower level relative to the bottom of the growth trough.

In a preferred embodiment the plant-growth trough and the discharge channel have a common wall and drainage from the sections of the growth trough is provided by perforations of the common wall between each individual section and the discharge channel. The drainage corresponding to the desired highest level of water in the growth trough may thus according to the invention be provided in that the common wall of the growth trough and the discharge channel extends upwards to said height above the bottom of the growth trough.

By extending according to the invention the wall of the growth trough facing the wall adjacent to the discharge channel downwards beneath the bottom of the growth trough by a length corresponding to the distance the outer surface of the bottom of the discharge channel is located below the bottom of the growth trough, a supporting frame is obtained which makes it possible to mount the growth trough according to the invention on a plane surface supported by said supporting frame and the underside of the discharge channel.

According to the invention the growth trough and the discharge channel may be manufactured as an extruded profile member provided at its ends with end walls having connecting nipples at the portion closing the ends of the discharge channel so that liquid from one discharge channel may be flown further into the next one or to a reservoir.

According to the invention the growth trough may between its end walls be further divided into sections by the insertion of partition walls dividing the growth trough but not the discharge channel.

The invention will now be explained in detail with reference to the drawings, in which

Fig. 1 is a perspective view of adjacent end portions of two sections of a growth trough according to the invention with sheet material as growth media,

Fig. 2 is a perspective view of two adjacent end portions of two sections of a second embodiment of the growth trough according to the invention with planting sacks as growth media,

Fig. 3 illustrates the cross-sectional profile of the trough shown in Fig. 1,

Fig. 4 illustrates the cross-sectional profile of the trough shown in Fig. 2, and

Fig. 5 is a schematical view of the mounting of a profile portion to form a sectionally divided growth trough according to the invention.

Fig. 1 illustrates two adjacent end portions of an embodiment of a plant-growth trough according to the invention. The trough proper is constituted by a rear wall 1, a bottom 2 and a front wall 3, said latter including discharge openings 5 at a level above the bottom of the growth trough. Discharge openings may be provided at various levels, openings provided below the individually desired level of liquid in the trough being plugged, but only the openings 4 immediately

above the bottom of the trough and the openings 5 corresponding to the highest desired level are shown.

Excess liquid is drained away from discharge openings 4 or 5 to a discharge conduit consisting in the illustrated embodiment of a trough, the bottom 6 of which is at a lower level relative to bottom 2 of the plant-growth trough, and the side wall 7 of which facing towards the growth trough merges above bottom 2 of the growth trough into wall 3 of the plant-growth trough, said wall 3 being actually as relates said portion common to the plant-growth trough and the discharge channel.

Wall 1 of the growth trough opposite the drain conduit is extended down below bottom 2 of the growth trough to form a supporting frame 8 terminating at such a distance from bottom 2 of the plant-growth trough that the bottom of the growth trough when the trough is mounted on a plane bed carried by the supporting frame 8 and bottom 6 of the discharge channel is horizontal or is slightly sloping down towards the discharge channel. The cavity thus formed beneath bottom 2 of the growth trough may be used to advance heating hoses or it may be filled with insulating material.

The plants are grown with their root structure in a plate 9 of porous material. The supply of water and fertilizer is effected by dripping water in the vicinity of the stem of the plant. The supplied water is absorbed by the porous plate while excess water flows along bottom 2 of the trough and discharges through discharge openings 4 into the discharge channel. If a higher level of liquid is desired, said openings are plugged, following which excess water will be collected in the growth trough until reaching discharge openings 5.

At its one end the illustrated section is defined by an end cover 10 also covering the end of the

discharge channel. While the end cover 10 bstructs the entire cr ss-section of th growth trough it is provided with a nipple, thereby allowing for connecting it by a hose or pipe joint 11 with a corresponding nipple on the end cover of the neighbouring section so that drain water may flow along a number of aligned trough sections to an outlet.

Fig. 2 illustrates two adjacent end portions of a second embodiment of the plant-growth trough according to the invention. Members corresponding to those illustrated in Fig. 1 have the same reference numerals.

The embodiment illustrated in Fig. 2 differs from that illustrated in Fig. 1 in that the plants are now nurtured in planting sacks 12. If it is desired to drain away any excess water not absorbed by the porous filler of the planting sack, use is made of discharge openings 4 at the bottom of the growth trough, perforations being provided at the bottom of the planting sack. If a certain level of water is desired at the bottom of the planting sack, openings 13 are cut in the walls of the sack corresponding to the desired liquid level. Water escaping through the apertures in the walls of the planting sack may be drained away through openings 4 at the bottom of the plant-growth trough, or by plugging the openings a certain liquid level may be obtained in the growth trough dependent on drain openings at a higher level of wall 3 of the trough. The highest possible liquid level in the trough is in the illustrated embodiment determined by the height of the wall 3.

The plant-growth trough with discharge channel may advantageously be extruded for instance from PVC plastic material having the profile shown in Fig. 3 to obtain the embodiment illustrated in Fig. 1, or having the profile shown in Fig. 4 to obtain the embodiment illustrated in Fig. 2.

Suitable lengths of the extruded profile may as indicated in Fig. 5 be terminated by end walls 10 that are squeezed, glued, welded or in any other way are sealed liquid-tight to the profile along its end profile edges. When using the illustrated end walls an incision, not shown, must be cut at the end of supporting frame 8 in order to accommodate the folded edge of the end bottom. End bottoms without folded edges may in a manner not shown be used as well.

Finally, an extruded trough member may be divided into more sections by internal partition walls 14 in the plant-growth trough while, obviously, no division is effected of the discharge channel of the member.

In the described embodiments the discharge channel is formed intergrally with the growth trough but an embodiment with a separated discharge channel that may be formed as a collecting pipe into which the drain water is passed through conduits communicating with each discharge of the plant-growth trough also falls within the scope of the invention. In the illustrated embodiments the discharge channel may, moreover, be covered in order to prevent unnecessary evaporation.

PATENT CLAIMS

1. A plant-growth trough for earthless growing of drip watered plants in planting sacks or growth plates of porous material in which the irrigation is supplied as dripping water close to the stem of the plant, said trough being divided into sections, characterized in that each section beyond at least one bottom discharge of the plant-growth trough includes at least one drainage in a more elevated position determining the liquid level in the section when the bottom discharge is plugged, and that the bottom discharge as well as the more elevated drainage are in communication with a discharge channel separated from the trough.

2. A plant-growth trough as claimed in claim 1, characterized in that the discharge channel is constituted by a trough extending longitudinally of the growth trough, the bottom of which is positioned at a lower level relative to the bottom of the growth trough.

3. A plant-growth trough as claimed in claim 2, characterized in that the growth trough and the discharge channel have a common wall and that drainage from the sections of the growth trough is provided by perforations of the common wall between each individual section and the discharge channel.

4. A plant-growth trough as claimed in claim 3, characterized in that the common wall of the growth trough and the discharge channel extends upwards to a height above the bottom of the growth trough corresponding to the desired highest level of liquid in the growth trough.

5. A plant-growth trough as claimed in claim 3 or 4, characterized in that the wall of the growth trough facing the wall adjacent the discharge channel is extendmd by a length downwards beneath the bottom of the growth trough corresponding to the portion the

uter surface of the bottom of the discharge channel is located b low the bottom of the growth trough.

6. A plant-growth trough as claimed in any of claims 3 to 5, characterized in that the growth trough and the discharge channel are manufactured as an extruded profile member provided at its ends with end walls having connecting nipples at the portion closing the ends of the discharge channel.

7. A plant-growth trough as claimed in claim 6, characterized in that partition walls are inserted between the end walls which divide the growth trough into sections.

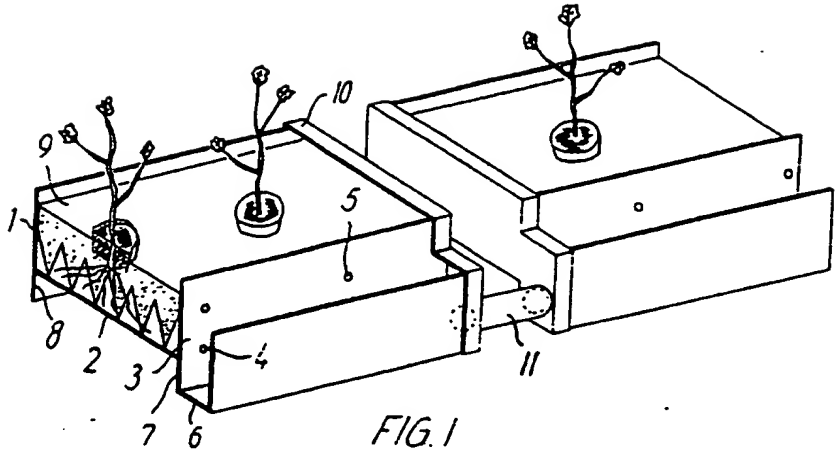

FIG. 1

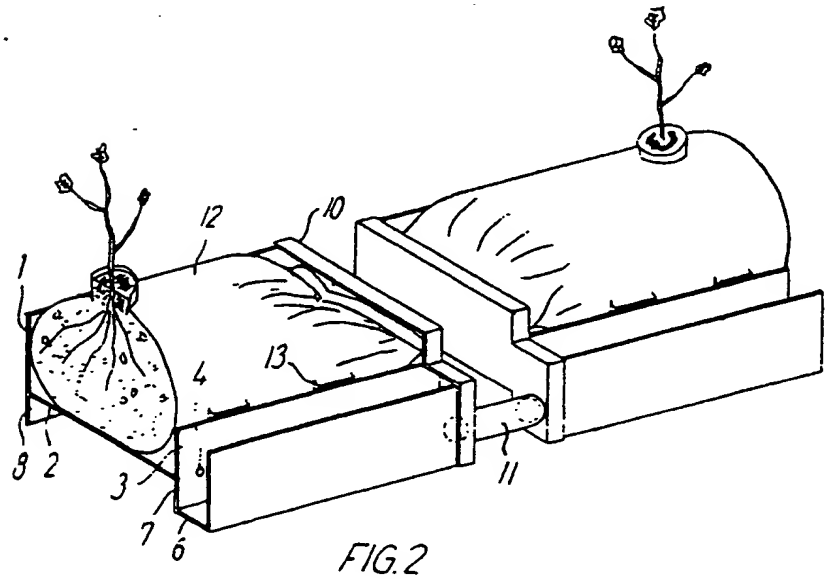

FIG. 2

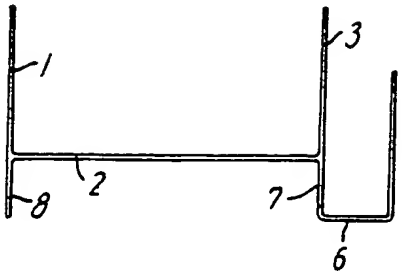

FIG. 3

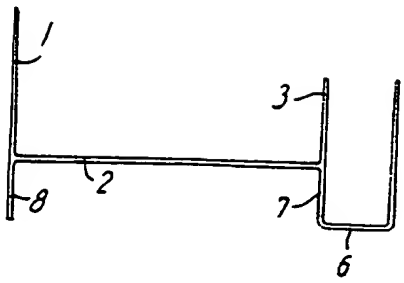

FIG. 4

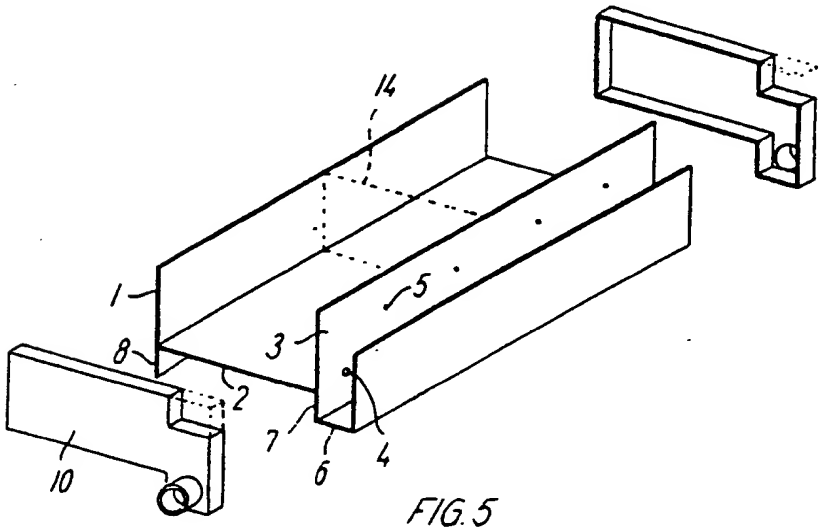

FIG. 5

INTERNATIONAL SEARCH REPORT

International Application No PCT/DK88/00194

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC 4

A 01 G 31/02

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC 4	A 01 G 9/00, /02, /10, 27/00, 31/00, /02
US Cl	47:59, 60, 62, 66, 79

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	US, A, 2 639 549 (G J HILLEGONDUS ET AL) 26 May 1953 See figure 1	1-7
Y	GB, A, 1 162 188 (E W HUGHES) 20 August 1969 See whole document	1-7
Y	DK, A, 147 871 (GERRIT JAN STOLZE) 1985-01-02 See whole document	6

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
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